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Cobb

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(54) **MULTI-CONDUIT SYSTEM**

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(73) Assignees: **Dan Godwin**, Sydney (AU); **Richard Cobb**, Sydney (AU)

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F16L 5/14 (2006.01)
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(58) **Field of Classification Search**
CPC F16L 39/00; F16L 5/14; F16L 43/008; H02G 3/0468; H02G 3/06; H02G 3/0487; H02G 3/0481
See application file for complete search history.

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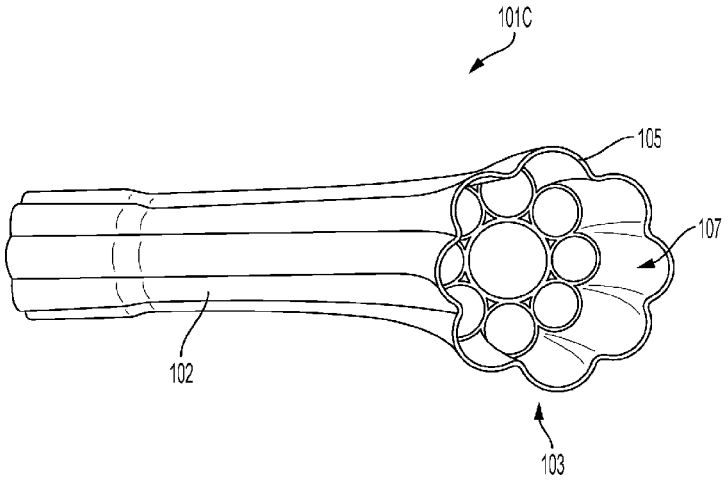
(57) **ABSTRACT**

A multi-conduit system has a joiner section comprising a plurality of conduits in parallel and a joining end for connection to a plurality of exposed like conduits of an adjacent section in use. The conduits of the section terminate at a proximal end of the joining end which comprises a collar widens in diameter from the conduits to form an open mouth. The collar defines an inner profile having a plurality of lobes having respective inner profiles corresponding to outer profiles of respective exposed like conduits such that, in use, when the like conduits of the adjacent section are inserted into the mouth, the lobes of the collar non-rotatably engage the like conduits to correctly align each conduit of the section with a respective like conduit of the adjacent section.

24 Claims, 9 Drawing Sheets



(51) **Int. Cl.**

F16L 43/00	(2006.01)
H02G 3/04	(2006.01)
H02G 3/06	(2006.01)

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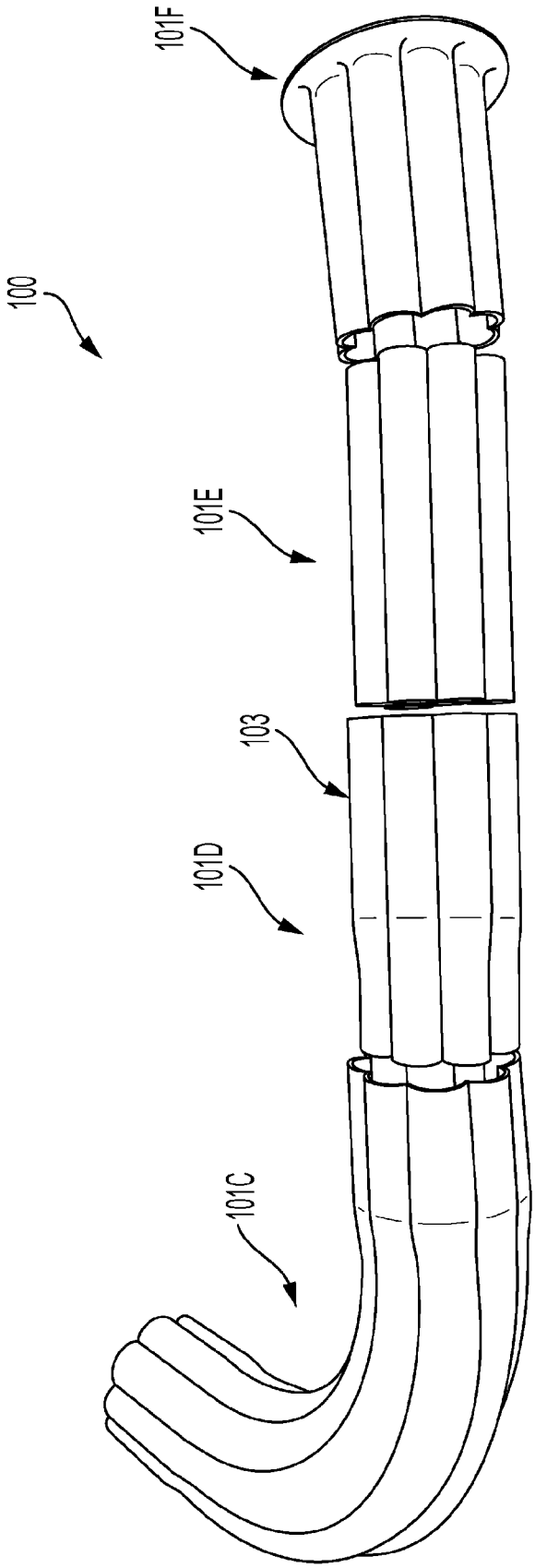

FIG. 1

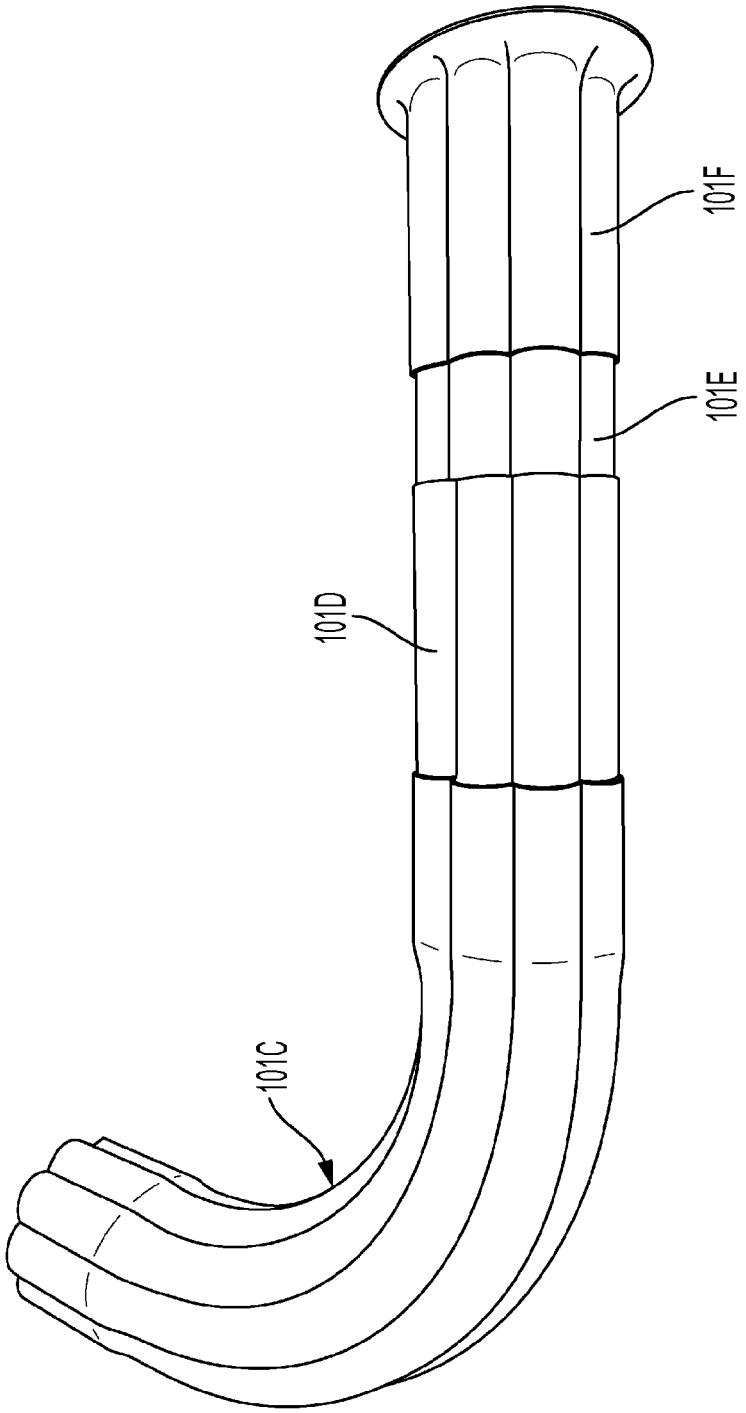

FIG. 2

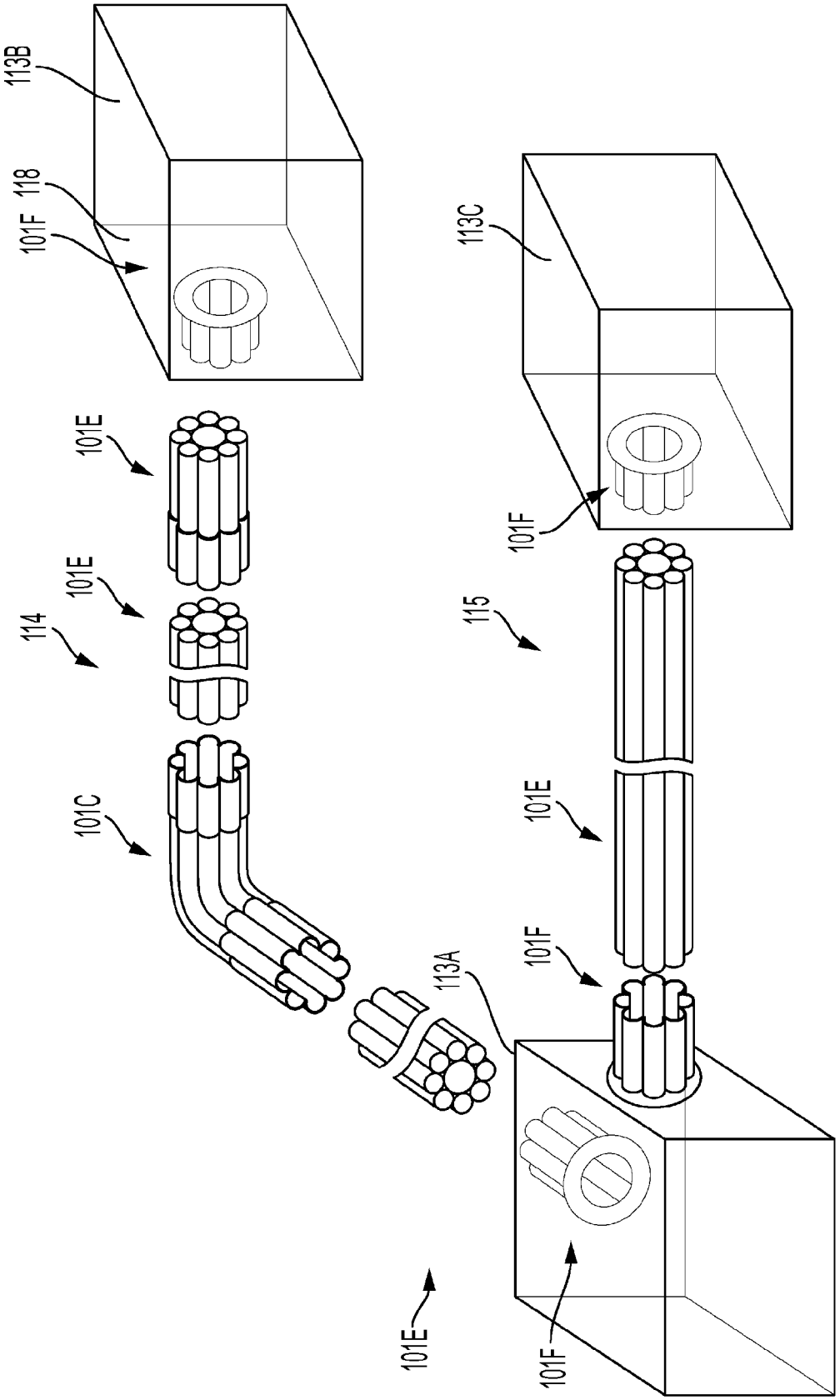
113B
118
101F
113C
101E
101E
114
115
101C
101E
101F
113A
101E
101F

FIG. 3

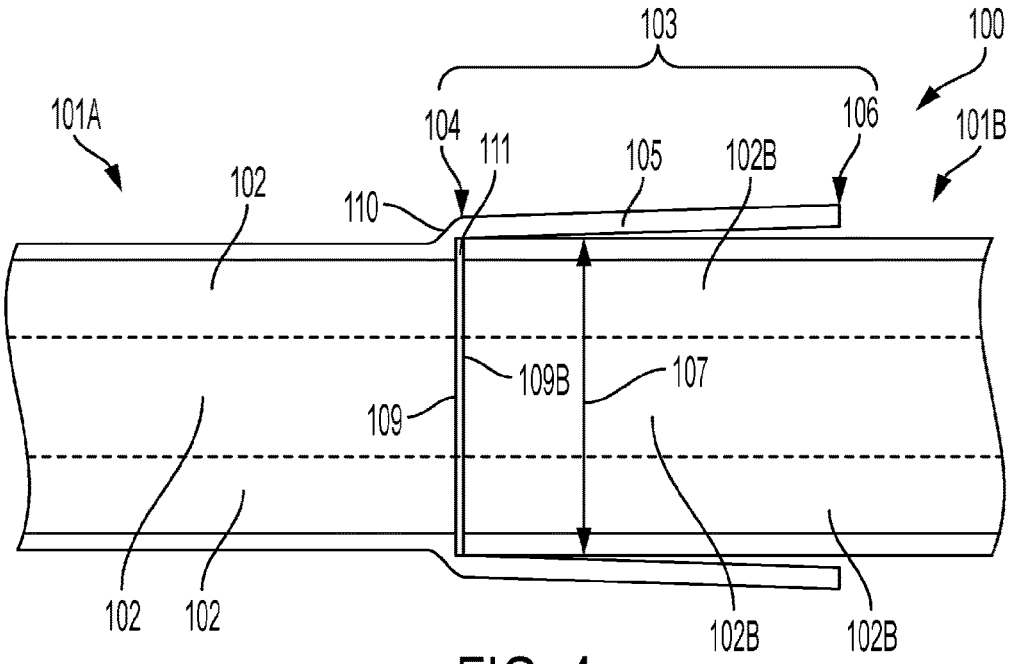
103
100
101A
104
111
105
106
101B
102
110
102B
109B
107
109
102
102
102B
102B

FIG. 4

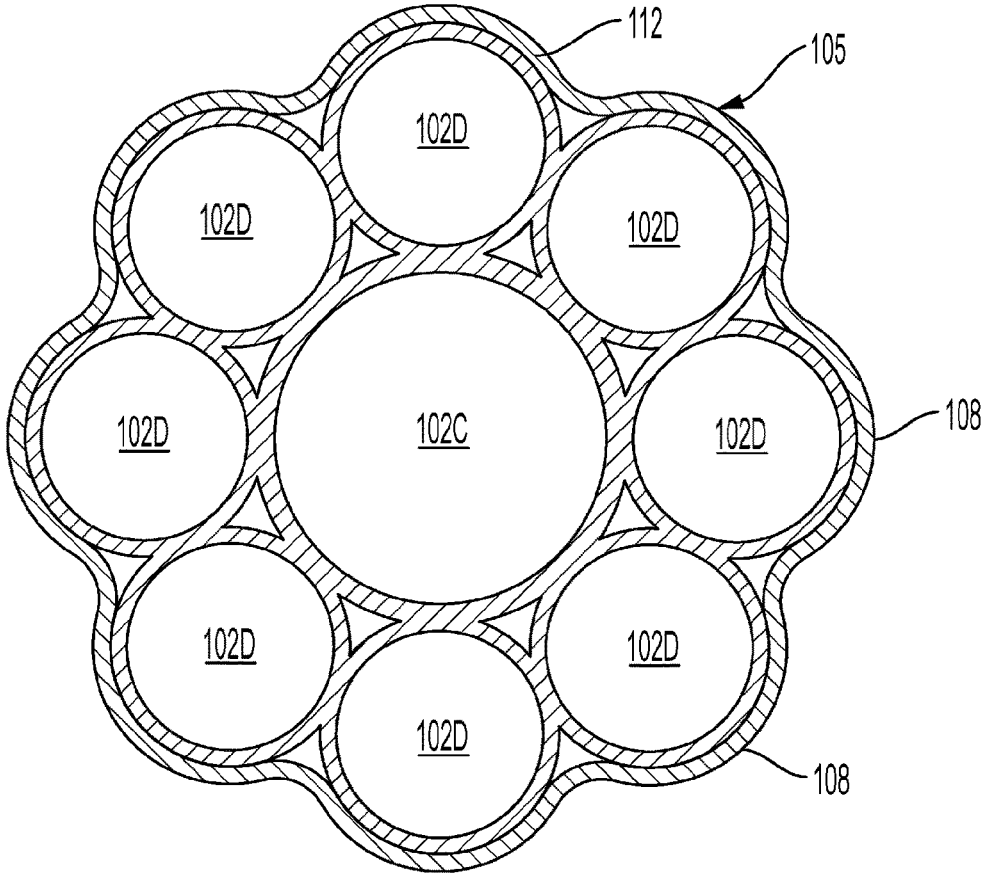
112
105
102D
102D
102D
102D
102C
102D
108
102D
102D
102D
108

FIG. 5

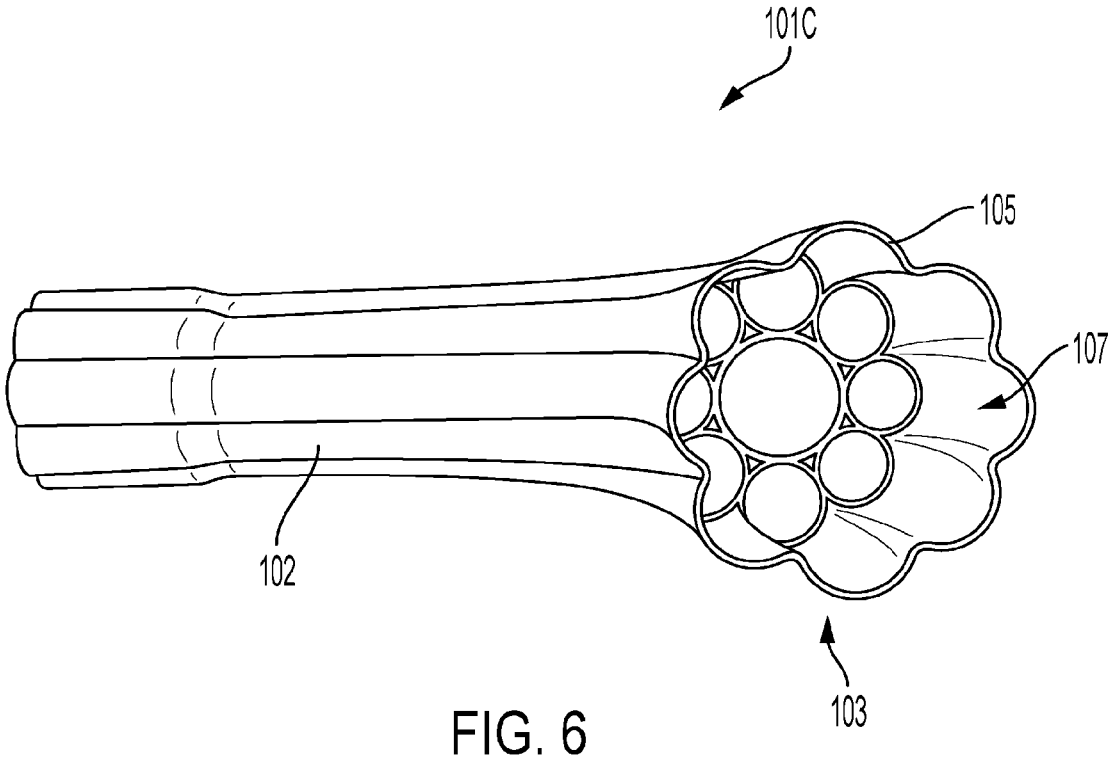

FIG. 6

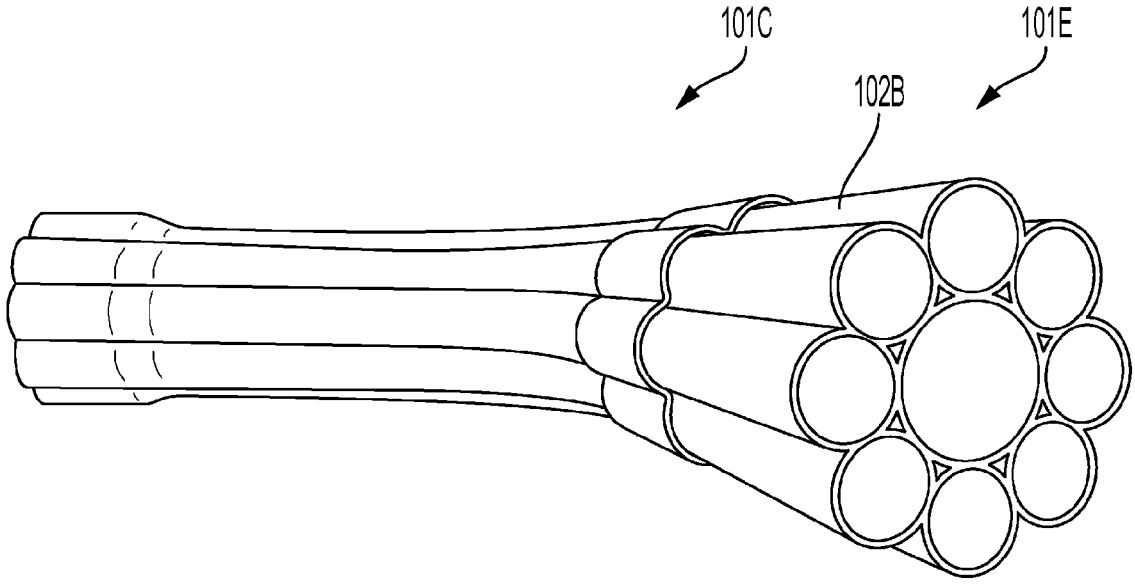

FIG. 7

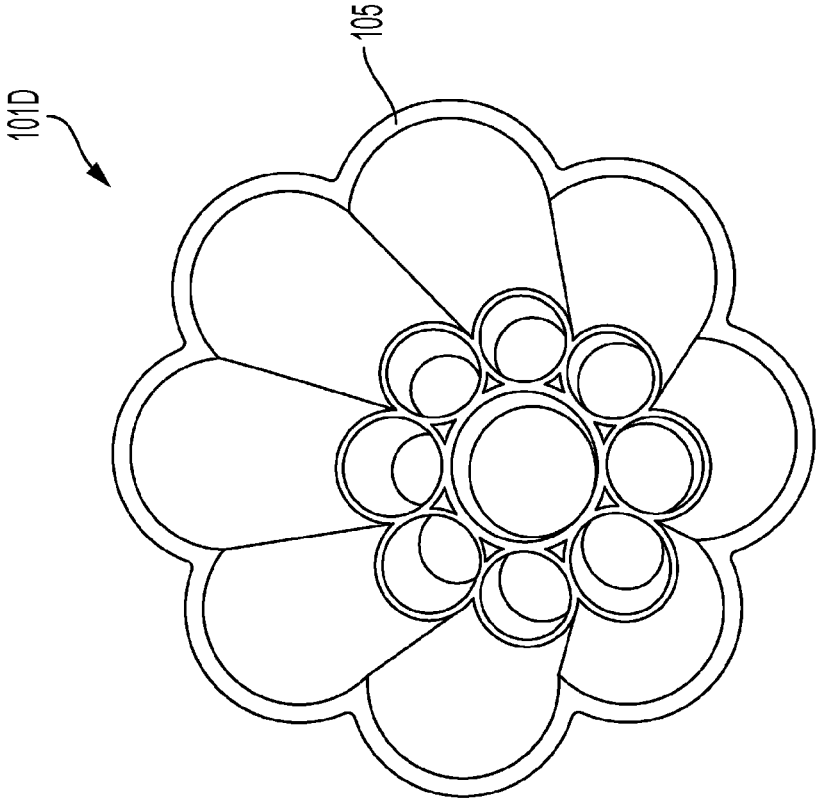

FIG. 9

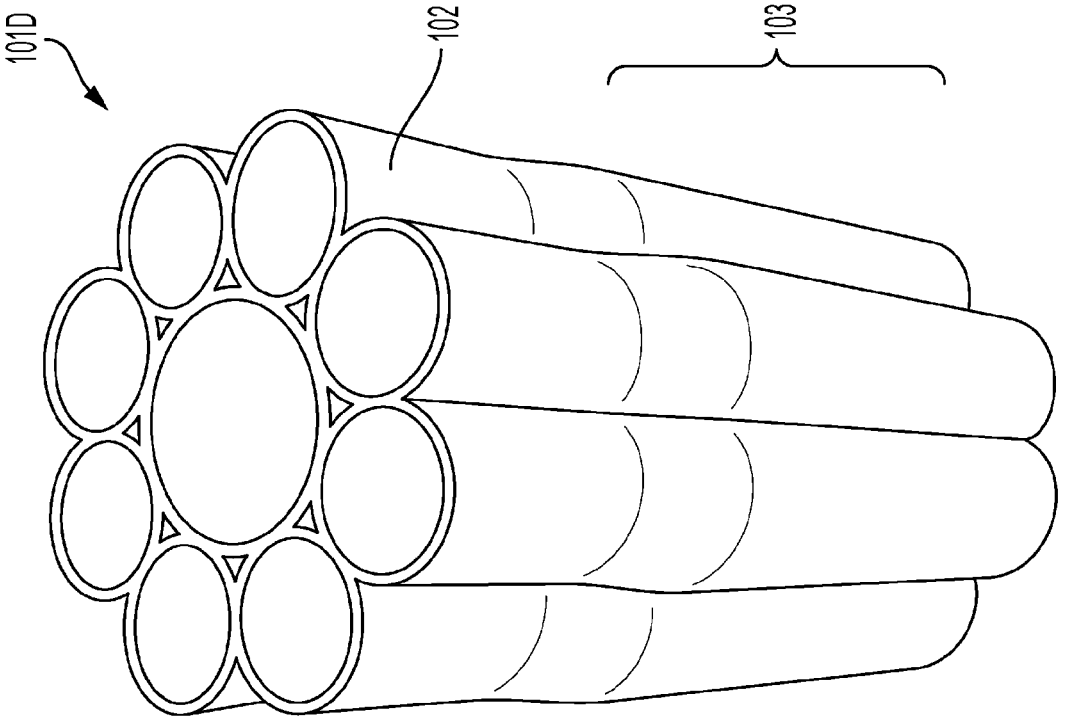

FIG. 8

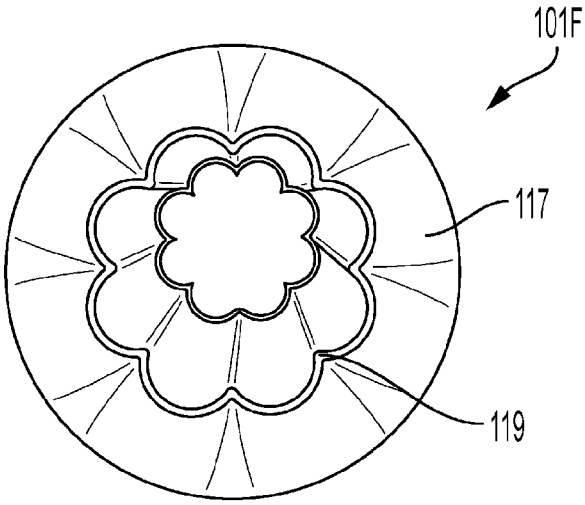

FIG. 10

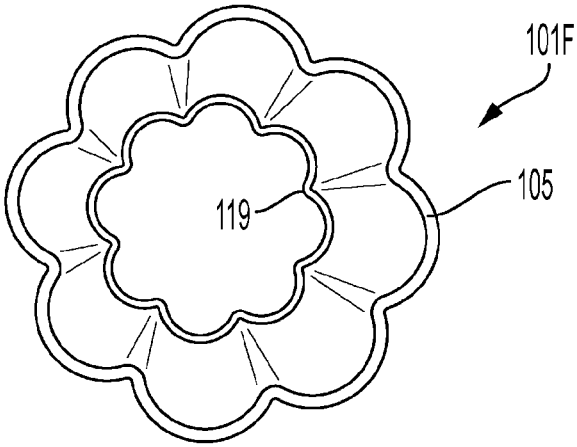

FIG. 11

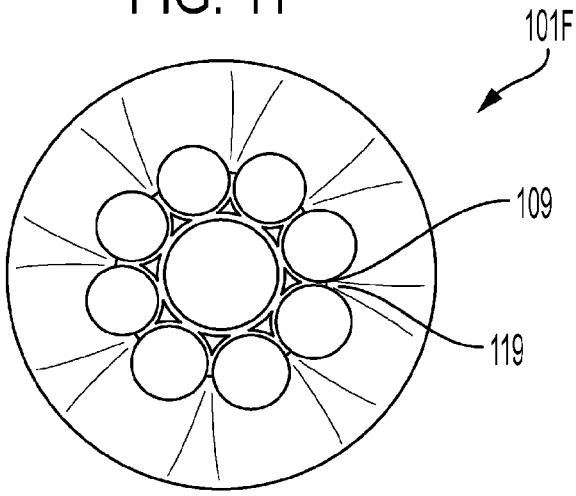

FIG. 12

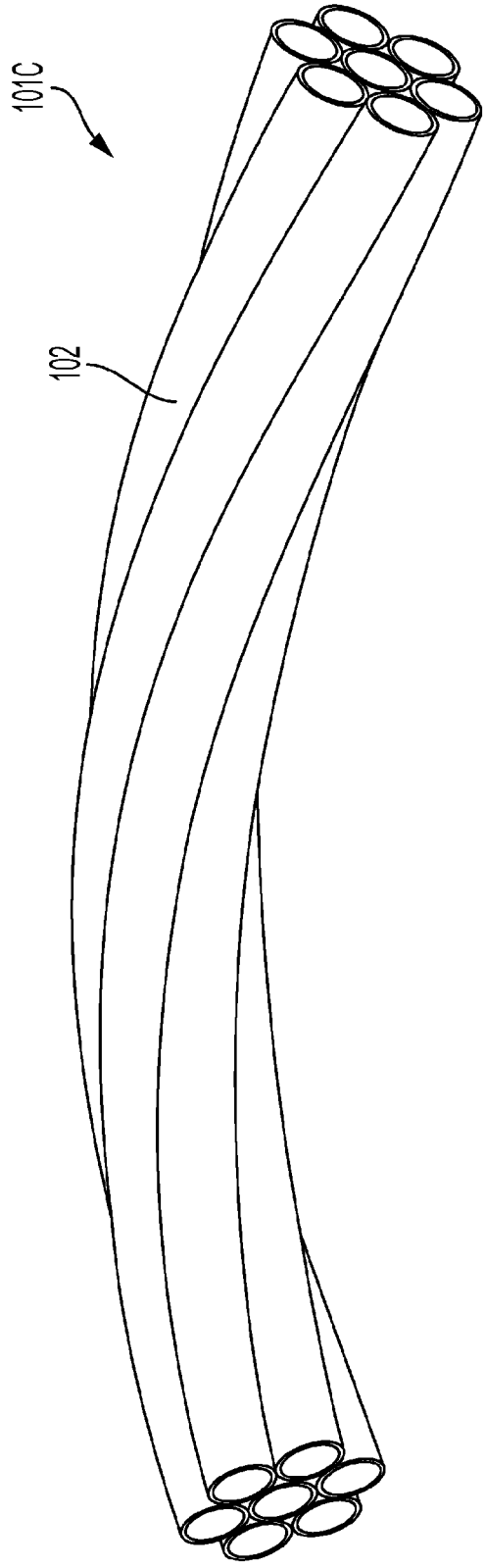

FIG. 13

FIG. 14

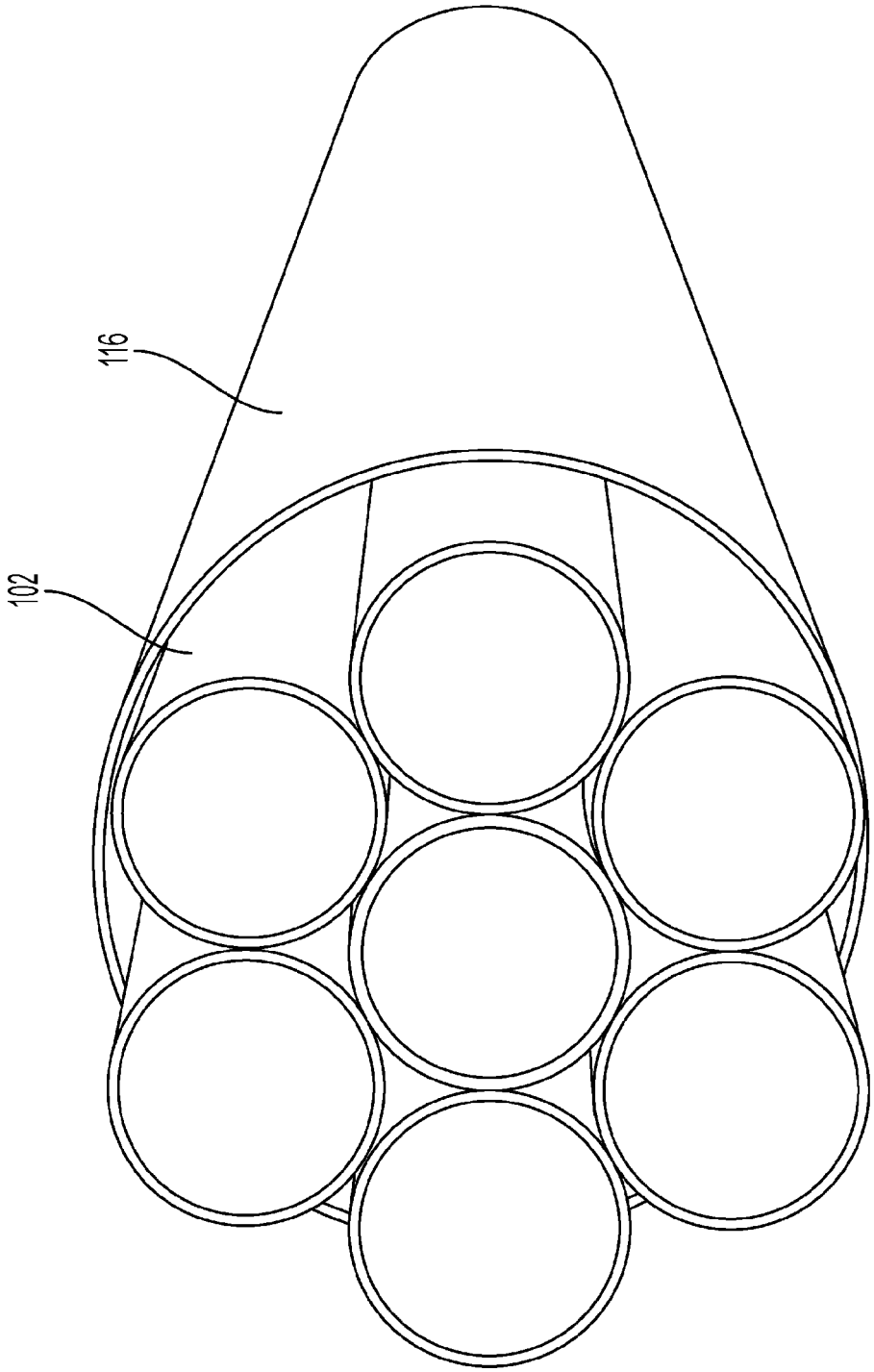

FIG. 15

MULTI-CONDUIT SYSTEM

FIELD OF THE INVENTION

This invention relates generally to cable conduits and accessories for subterranean cable reticulation. More particularly, this invention relates to a multi-conduit system for separation of subterranean services.

BACKGROUND OF THE INVENTION

Subterranean PVC conduits are used for reticulation of data and electrical cabling. Usually, these conduits are run between buried concrete junction boxes, pits, buildings and structures.

Problems occur however during upgrade and maintenance wherein new cables are required to be run through existing conduits, including those having existing cabling therein.

A typical procedure entails running a resiliently flexible "snake" through the conduit to the far end whereafter the new cable is attached to the exposed distal end thereof which is pulled back through the conduit. Successfully running a snake through a conduit successfully is especially difficult for crowded conduits and/or conduits having twisted cables therein, let alone pulling the new cable back therethrough.

U.S. Pat. No. 5,372,388A (Gargiulo) 1994 Dec. 13 discloses a conduit system for underground fibre optic cable installation which has an integral multi-conduit conduit section having an outer housing having a straight coupling portion at one end and a belled coupling portion at the other end, a plurality of innerconduits disposed in a parallel manner within the outer housing and one or more spacers for parallel positioning said innerconduits in the outer housing. A three-piece innerconduit coupler disposed within the belled portion of the outer housing and engaged with the trailing ends of a plurality of innerconduits allows linear interconnection of with like conduit sections. The innerconduit coupler includes a guide for facilitating entry of the plurality of innerconduits of an adjacent conduit section into a like section; a seal that creates an air and water tight seal between the adjacent innerconduits when like sections are interconnected, without the need for cement or sealing lubricants.

U.S. Pat. No. 5,078,432A (Seiter) 1992 Jan. 7 discloses another multiple conduit conduit system for underground light guide cable installation having conduit sections which each include a coupling assembly mounted at one end of each conduit section having an outer cylindrical coupling and an inner coupling. The inner coupling includes an inner receptacle having a support plate with sockets mounted to both sides of the support plate in alignment with openings in the support plate. When the conduit sections are connected in end-to-end relationship, the protruding inner conduits of one conduit section are moved into the coupling assembly until the inner conduits are moved into the inner coupling assembly, whereupon the relatively small openings of O-rings are stretched so as to permit passage therethrough of the inner conduits to forms a seal about the inner conduits.

U.S. Pat. No. 5,135,265A (Bouscher et al) 1992 Aug. 4 discloses a flexible, multiple passage conduit assembly for use in fibre optic systems which comprises an outer elongated housing formed from circumferentially corrugated flexible plastic conduit of cylindrical configuration. A separate rigid end fitting member of generally cylindrical configuration is joined to each end of the conduit to close the ends and allow for joining the assembly to associated multiple passage conduits. A plurality of lengths of hollow flexible plastic tubing are located within the conduit housing to extend the length thereof. The lengths of tubing terminate in open ends adjacent the end fittings. The open ends of the tubing are connected to the end fitting members by connections which permit relative axial movement between the lengths of tubing and at least one of the end fitting members.

The present invention seeks to provide multi-conduit conduit system, which will overcome or substantially ameliorate at least some of the deficiencies of the prior art, or to at least provide an alternative.

It is to be understood that, if any prior art information is referred to herein, such reference does not constitute an admission that the information forms part of the common general knowledge in the art, in Australia or any other country.

SUMMARY OF THE DISCLOSURE

There is provided herein a multi-conduit system comprising a joiner section comprising a plurality of conduits in parallel and having a joining end for connecting to a plurality of like conduits of an adjacent section in use.

The conduits of the section terminate at a proximal end of the joining end and the joining end comprises a collar extending from the proximal end to a distal end of the section. The collar widens in diameter from the conduits to form an open mouth.

The collar defines an inner profile having a plurality of lobes having inner profiles corresponding to outer profiles of respective like conduits. As such, in use, when the like conduits of the adjacent section are inserted into the mouth, the lobes of the collar non-rotatably engage the like conduits to correctly align each conduit of the section with a respective like conduit of the adjacent section.

The collar may be sized to frictionally engage the like conduits of the adjacent section and may form an airtight connection which may allow pneumatic blowing of fibre through the conduits.

The sections may be formed to reduce or eliminate gaps or edges between aligned conduits which may snag or hinder reticulation of cable therethrough.

The present configuration has manufacture cost advantages in light of the aforedescribed existing arrangements including in comprising less componentry and may be easier to install wherein sections may be simply plugged together wherein the configuration of the collar lobes allows for the correct alignment of conduits without creating interior edges or gaps which may hinder cable reticulation.

The conduits may comprise a central conduit surrounded by a plurality of outer conduits which optimises interior cross section and structural resilience. Each other conduit may be connected at three points (i.e., by interfacing a pair of adjacent outer conduits and the inner conduit) which increases structural resilience and adjacent walls of conduits may converge which increases structural resilience and minimises the maximum diameter of the conduits.

In alternative embodiments, the conduits **102** may not be circular in cross-section but may different cross-section which maximises volumetric cross-section and minimises overall diameter of the section **101**. For example, the conduits **102** may be hexagonal and wherein adjacent conduit **102** share straight walls therebetween.

The sections may include corner sections wherein the conduits go through a bend. The conduits of the corner section may be helical to eliminate conduit length differences between either end thereof. In other words, the helical

conduits provide a uniform and equal length and radii through a change of direction for all of the conduits **102**.

The sections may include a straight section which may be cut to length to join adjacent sections having respective joining ends. The sections may include a joining section which may be straight, have conduits extending straight from one end thereof and have a joining end extending from the other end thereof thereby allowing female-to-female or male-to-male interfacing of sections.

The system may include a pit bush section for interfacing through walls of cable pits, including in a way which prevents sharp edges.

The sections may be colour-coded or mechanically keyed so ends of conduits may be identified at each end of the system.

The sections may comprise a diameter off 100 mm allowing for retrofit in existing cable systems.

Unused conduits may be individually sealed, including with Jack Moon duct plugs for rodent prevention.

Other aspects of the invention are also disclosed.

BRIEF DESCRIPTION OF THE DRAWINGS

Notwithstanding any other forms which may fall within the scope of the present invention, preferred embodiments of the disclosure will now be described, by way of example only, with reference to the accompanying drawings in which:

FIG. **1** shows a disassembled multi-conduit system in accordance with an embodiment;

FIG. **2** shows the system of FIG. **1** assembled;

FIG. **3** illustrates utilisation of the system for forming multichannel interconnections between data and/or communication pits;

FIG. **4** shows a side elevation view of the interconnection of adjacent sections in accordance with an embodiment;

FIG. **5** shows an end cross-sectional view of the interconnection of the adjacent sections of FIG. **4**;

FIG. **6** shows an end perspective view of a corner section in accordance with an embodiment;

FIG. **7** shows the corner section engaging a straight section;

FIG. **8** shows a first end of a joiner section of the system in accordance with an embodiment;

FIG. **9** shows an opposite end of the joiner section of FIG. **8** having a joining end;

FIG. **10** shows a first end perspective view of a pit bush section in accordance with an embodiment;

FIG. **11** shows an opposite end perspective view of the pit bush section of FIG. **10**;

FIG. **12** illustrates the interconnection of conduits of the section with the pit bush of FIG. **10**;

FIGS. **13** and **14** show a corner section comprising a helical arrangement of conduits;

FIG. **15** shows wherein the conduits **102** a protected within an exterior jacket.

DESCRIPTION OF EMBODIMENTS

With reference to FIG. **4**, a multi-conduit system **100** comprises a joiner section **101**A comprising a plurality of conduits **102** in parallel and having a joining end **103** for connection to a plurality of exposed like conduits **102**B of an adjacent section **101**B in use.

The conduits **102** of the section **101**A terminate at a proximal end **104** of the joining end **103** and the joining end **103** comprises a collar **105** extending from the proximal end **104** to a distal end **106** of the section **101**A and which widens in diameter from the conduits **102** to form an open mouth **107**.

The collar **105** defines an inner profile best seen in FIG. **5** having a plurality of lobes **108** having inner profiles corresponding to outer diameters of respective like conduits **102**B. The lobes **108** may be generally semicircular in cross-section to follow around the outside of each generally circular conduit **102**.

As such, in use, when the like conduits **102**B of the adjacent section **101**B are inserted into the mouth **107**, the lobes **108** of the collar **105** non-rotatably engage the exposed like conduits **102**B to correctly align each conduit **102** of the section **101**A within a respective like conduit **102**B of the adjacent section **101**B.

The inner profile of the collar **105** may be configured so that the collar **105** frictionally engages the like conduits **102**B of the adjacent section **101**B. The frictional engagement may be sufficient alone to substantially prevent the sections **101** pulling apart but, in embodiments, sections **101** may be glued together with suitable adhesive, such as conventional pipe glue. In embodiments, mechanical interlock (not shown) may together to hold the sections **101** together.

The inner profile of the collar **105** may be sufficient to form a substantially airtight (or watertight) seal between sections **101**, suitable for blowing of optic fibre and the like therethrough.

In embodiments, the collar **105** may decrease in diameter towards a proximal end **104** so the friction between the collar **105** and the like conduits **102** of the adjacent section **101**B increases as the conduits **102**B insert further into the mouth **107**.

The section **101** is preferably integrally formed. The section **101** and preferably the conduits **102** thereof are preferably rigid conduits, such as made from Polyvinyl Chloride (PVC) plastic plastic.

Furthermore, as is shown in FIG. **5**, the collar **105** may have a uniform wall thickness. In other words, the outer profile of the collar **105** may follow the inner profile thereof.

Again, with reference to FIG. **4**, the conduits **102** may define an interfacing face **109** and the like conduits **102**B from an adjacent interfacing face **109**B which mate flush without a substantial gap therebetween when the like conduits **102**B are engaged within the collar **105**. The faces **109**, **109**B may be planar and orthogonal with a longitudinal axis of the respective conduits **102**, **102**B.

The collar **105** may comprise a length of between 80 mm and 150 mm, preferably approximately 100 mm or 120 mm.

Furthermore, the section **101** may comprise an external diameter of approximately 100 mm.

Referencing FIG. **4**, the section **101**A may have a smooth exterior transition **110** between an exterior surface of the conduits **102** and the collar **105**.

The section **101** however may have an interior step transition **111** between the conduits **102** and the inner surface of the collar **105** thereby forming a peripheral edge **112** shown in FIG. **5**. The peripheral edge **112** may comprise a thickness matching that of the conduits **102** so that inner surfaces or adjacently aligned conduits **102** match exactly without creating edges which may snag or hinder reticulation of cable therethrough.

FIG. **1** shows wherein the system **100** comprises different types of sections **100**.

The sections **101** may comprise a corner section **101**C which bends through an angle, such as 90°.

The sections **101** may comprise a joiner section **101**D which is straight and which has the aforedescribed joining end **103** at one end thereof.

The sections **101** may further comprise a straight section **101**E comprising a plurality of parallel conduits **102** and which may be of variable lengths, such as 4 m lengths and which may be cut to length in use.

The sections **101** may further comprise a pit bush **101**F.

As is shown in FIG. **2**, these sections **101** may be joined together in various configurations to make various conduit paths for different types of services, such as data and electrical services. In use, different types of services are run through different conduits **102**.

Specifically, FIG. **3** shows the system **100** used for forming multiple conduits interconnecting data and/or electrical service pits **113**.

Specifically, FIG. **3** shows the sections **100** forming a right-angled interconnection **114** between a first pit **113**A and second pit **113**B.

The right-angled interconnection **114** comprises a straight section **101**E interfacing a pit bush **101**F of the first pit **113**A and the corner section **101**C which interfaces a further straight section **101**E which, in turn, interfaces a joiner section **101**E. The conduits **102** of the joiner section **101**E may interface a further pit bush **101**F of the second pit **113**B.

In embodiments, a straight-through joiner section (not shown) may be provided which essentially just comprises the aforedescribed collar **105** (i.e., comprising the plurality of lobes **108**) which can be used to interconnect exposed conduits **102** of adjacent straight sections **101**E in alignment.

FIG. **3** shows the forming of a straight interconnection **115** between the first pit **113**A and a third pit **113**B which comprises a straight section **101**E interfacing respective pit bushes **101**F of the first pit **113** and the third pit **113**C.

FIG. **6** shows the corner section **101**C in further detail which goes through 90°. However, in alternative embodiments, corner sections **101**C may be provided to go through other angles, including 45°. In embodiments, the conduits **102** of the corner section **101**C may be slightly flexible so as to allow the corner section **101**C to make arbitrary angles. FIG. **6** shows the mouth **107** formed by the collar **105** of the joining end **103** and FIG. **7** illustrates the insertion of the straight section **101**C therein. FIG. **6** shows how the interface face **109** of the conduits **102** are recessed within the collar **105** to form a deep mouth **107** for receipt of the like conduits **102**B of the straight section **101**E therein and how the interface faces **109**, **109**B meet flush so as to prevent gaps between the conduits **102**, one 0 to be.

FIGS. **13** and **14** show an embodiment wherein the corner section **101**C comprises helical conduits **102**. The conduits **102** are helical to reduce or eliminate differences in lengths of the conduits **102** between either end of the section **101**C. In a preferred embodiment, each conduit **102** may spiral through 180° between ends of the conduit **102**C so that each conduit **102** is exactly of the same length. The FIGS. **13** and **14** show wherein the corner section **101**C is devoid of joining ends **102**.

FIG. **15** shows an embodiment wherein the conduits **102** are protected within an outer protective sheath **116** and wherein the distal ends of the conduits **102** extend from the end of the sheath **116** to allow for insertion within a joining end **103**.

FIGS. **8** and **9** show the straight joining section **101**D in further detail. FIG. **8** shows the end of the joining section **101**D opposite the joining end **103** wherein the conduits **102** extend parallel and straight therefrom. FIG. **9** shows the widening of the joining end **105** from the conduits **102**.

FIGS. **10-12** illustrate the pit bush **101**F in further detail. The pit bush **101**F comprises a flange **117** which, as is illustrated in FIG. **3**, may interface against an exterior surface around an aperture within a vertical wall **118** of the pit **113**.

In embodiments, the pit bush **101**F may comprise conduits **102** extending from the flange **117**. However, the embodiment shown in FIGS. **10-12** shows wherein the pit bush **101**F comprises a collar **105** forming a joining end **103**. The collar **105** may go right up to the flange **117** so that conduits **102** of a section **101** inserted therein may abut against the flange **117**. The flange **117** may form an inner interfacing edge **119** extending in across the collar **105** which abuts against an interfacing face **109** of conduits **102** of a section **101** inserted therein as is illustrated in FIG. **12**.

The inner interfacing edge **119** may partially follow an inner diameter of the conduits **102** so that no edges or gaps are created between the conduits **102** and the interfacing edge **109** which may snag cable inserted therethrough.

As shown in FIG. **5**, section **101** may comprise an inner conduit **102**C and a plurality of peripheral outer conduits **102**. Each outer conduit **102** may be connected at three points to confer strength to the conduit **101**. Specifically, each outer conduit **102** may interface a pair of adjacent outer conduits **102**D and the inner conduit **102**C.

In the embodiment shown in FIG. **5**, the inner conduit **102**C of the larger diameter than the outer conduits **102**D. The inner conduit **102**C may comprise an internal diameter of 50 mm whereas each outer conduit **102**D may comprise an internal diameter of 32 mm. In the embodiment shown in FIG. **5**, the section **101** comprises eight outer conduits **102**D.

As is further shown in FIG. **5**, adjacent walls of conduits **102** may converge which may further strengthen the section **101** and minimise the maximum diameter thereof. As is shown, exterior wall surfaces of like conduits **102** may converge non-tangentially such that a wall thickness between like conduits **102** is less than the sum of the wall thicknesses of each adjacent conduit **102**.

The conduits **102** may be marked such as by with colour coding or the like to allow installers to follow separate channels through the system **100** for reticulation of respective services.

The sections **101** may be marked or keyed so that sections **101** are only connected together at one rotational offset. For example, the collar **105** may comprise an internal key portion which fits within a corresponding key portion of an adjacent section **101** when correctly aligned.

As such, during installation, the installer may install the sections **101** together as marked so as to maintain continuity of each conduit **101** so that respective ends of each conduit **101** may be identified at each end of the system **100**.

As described above, the conduits **102** may terminate at the planar interfacing face **109** and wherein the collar **105** aligns the sections **101** together to exactly align respective conduits **102** end-to-end to avoid cable snagging edges. In embodiments, edges of each conduit **102** may mechanically interconnect, such as in a male/female relationship to enhance airtightness and watertightness between aligned conduits **102**. In embodiments, one or both of aligned conduits **102** may seat a rubber O-ring which is compressed when ends of the conduits **102** come together to enhance the seal between end-to-end aligned conduits **102**. The O-ring may be configured so as to not extend across the conduit **102** to avoid snagging cable run therethrough.

In embodiments, reducing and/or splitting sections **101** (not shown) may be provided. A splitting section **101** may divert one or more of the conduits **102**. For example, a splitting section may comprise the aforedescribed collar **105** which engages the exposed eight outer conduits **102** but which splits one or more of the outer conduits **102** therefrom. For example, the splitting section **101** may divert one of the conduits **102** so that the remaining seven outer conduits **102** continue together in alignment. Alternatively, the splitting section **101** may divert a group of the outer conduits **102** together in alignment. For example, the splitting section **101** may split eight outer conduits **102** to two separate groups of sections **101** having four outer conduits **102**.

In embodiments, a reducing section **101** may terminate one more of the conduits **102**. For example, reducing section **101** may reduce a section **101** having eight outer conduits **102** to a section having seven outer conduits **102** or less.

The foregoing description, for purposes of explanation, used specific nomenclature to provide a thorough understanding of the invention. However, it will be apparent to one skilled in the art that specific details are not required in order to practise the invention. Thus, the foregoing descriptions of specific embodiments of the invention are presented for purposes of illustration and description. They are not intended to be exhaustive or to limit the invention to the precise forms disclosed as obviously many modifications and variations are possible in view of the above teachings. The embodiments were chosen and described in order to best explain the principles of the invention and its practical applications, thereby enabling others skilled in the art to best utilize the invention and various embodiments with various modifications as are suited to the particular use contemplated. It is intended that the following claims and their equivalents define the scope of the invention.

The term "approximately" or similar as used herein should be construed as being within 10% of the value stated unless otherwise indicated.

The invention claimed is:

1. A multi-conduit system comprising a joiner section comprising a plurality of conduits in parallel and having a joining end for connection to a plurality of exposed like conduits of an adjacent section in use, wherein the conduits of the joiner section terminate at a proximal end of the joining end and wherein the joining end comprises a collar extending from the proximal end to a distal end of the section and which widens from the conduits to form an open mouth for accepting the plurality of exposed like conduits of the adjacent section therein in use, wherein the collar defines an inner profile having a plurality of lobes having respective inner profiles corresponding to outer profiles of respective exposed like conduits such that, in use, when the exposed like conduits of the adjacent section are inserted into the mouth, the lobes of the collar non-rotatably engage the like conduits to align each conduit of the section with a respective exposed like conduit of the adjacent section and wherein the conduits comprise a circular inner conduit and a plurality of circular outer conduits surrounding the inner conduit and wherein each outer conduit interfaces a pair of adjacent outer conduits and the inner conduit at three points.

2. The system as claimed in claim **1**, wherein each lobe has a generally semi-circular cross-section.

3. The system as claimed in claim **1**, wherein the collar is sized to frictionally engage the conduits of the adjacent section.

4. The system as claimed in claim **3**, wherein the collar decreases in cross section towards the proximal end so that frictional engagement increases as the like conduits insert towards the proximal end.

5. The system as claimed in claim **1**, wherein the conduits and the collar are integrally formed.

6. The system as claimed in claim **5**, wherein the collar has uniform wall thickness.

7. The system as claimed in claim **6**, wherein an entire outer surface profile of the collar generally follows a corresponding entire inner surface profile of the collar.

8. The system as claimed in claim **1**, wherein the conduits terminate at an interfacing face at the proximal end and wherein the like conduits terminate at an adjacent interfacing face and wherein the interfacing face and the adjacent interfacing face meet flush and without a substantial gap therebetween when the like conduits are engaged within the collar.

9. The system as claimed in claim **8**, wherein the interfacing face and the adjacent interfacing face are each coplanar.

10. The system as claimed in claim **9**, wherein the interfacing face is orthogonal with respect to a longitudinal axis of the conduits.

11. The system as claimed in claim **1**, wherein the section has a smooth exterior transition between the conduits and the collar.

12. The system as claimed in claim **1**, wherein the section has an interior step transition between the conduits and the collar forming a peripheral internal edge and wherein the peripheral internal edge has a width matching a wall thickness of the like conduits.

13. The system as claimed in claim **1**, further comprising the adjacent section and wherein the adjacent section is a straight section comprising a plurality of straight conduits.

14. The system as claimed in claim **1**, wherein the joiner section comprises a joining end at both ends.

15. The system as claimed in claim **1**, wherein the system comprises a corner section comprising a plurality of conduits which go through a bend.

16. The system as claimed in claim **15**, wherein conduits of the corner section are helical.

17. The system as claimed in claim **16**, wherein each conduit of the corner section bends through 180° between ends of the corner section.

18. The system as claimed in claim **1**, wherein exterior wall surfaces of like conduits converge non-tangentially such that a wall thickness between adjacent conduits is less than the sum the wall thickness of each adjacent conduit.

19. The system as claimed in claim **11**, wherein the inner conduit has a larger diameter than that of the outer conduits.

20. The system as claimed in claim **19**, wherein the inner conduit is surrounded by eight outer conduits.

21. The system as claimed in claim **1**, further comprising a pit bush section comprising a flange having a rear face which engages around an aperture through a wall of a pit and against a wall of a pit in use, wherein pit bush section comprises a collar having a plurality of lobes and wherein the collar extends from the flange so that conduits of an adjacent section can abut against the flange.

22. The system as claimed in claim **21**, wherein the flange forms an inner interfacing edge extending in across the collar which abuts against an interface face of the conduits and wherein the inner edge partially follows an inner diameter of the like conduits so that there are no edges created between the conduits and the interfacing edge.

23. The system as claimed in claim 1, wherein the collar comprises a length of between 80 mm and 150 mm.

24. The system as claimed in claim 1, wherein the joiner section and the adjacent section are at least one of coded and keyed so that the section and the adjacent section are joined together in one rotational orientation in use so that respective pairs of conduits thereof are matched.

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